



Coastal Engineering Technical Note

COMPUTER PROGRAMS WITH COASTAL ENGINEERING APPLICATIONS

PURPOSE: This note discusses computer programs related to coastal engineering available from CERC and WES. Information on computer programs is scattered throughout a number of different sources: CERC reports, other tech notes, and WES' Engineering Computer Programs Library (ECPL) Catalog. Included in this note are brief descriptions of programs available on wave refraction, storm surge, inlets, beach profiling, soil mechanics, dredging, and wave height and setup. Numerous other computer programs are being used by CERC and WES for either project or research studies; however, these programs have not been documented to the extent of those included in this note. Additional technical notes will be issued periodically to announce major additions to the computer programs available for coastal engineering applications.

INTRODUCTION: All documented computer programs within the Corps of Engineers are identified by a unique number, XXX-YY-ZZZ. The X number identifies the subject area, the Y number identifies the type of computer on which the program is to run, and the Z number uniquely identifies the program.

The Programs Library at WES is tasked with storing and maintaining all the Corps of Engineers computer programs pertaining to planning, design, construction, and operation of Corps of Engineers projects. ECPL publishes a catalog, updated twice each year, containing abstracts of available programs. Each abstract contains: purpose of the program, computer language the program is written in and type of computer on which the program is designed to run, input required and output format, mathematical methods used, and additional remarks.

Some programs in the Programs Library can be accessed through the Boeing Computer System. Any Corps district ADP office can obtain an identification number from Boeing that will allow users to access programs on the system through a remote terminal. Upon request and receipt of a blank computer tape, the Programs Library will provide a copy of any of its programs. When a program

is available from both CERC and WES, it is best to request it and the documentation from the Programs Library at WES. If after reading the documentation, a question arises, contact the originating agency. The locations of the programs discussed are listed in the table.

TABLE PROGRAM LOCATIONS

Subject Area and Program Title (Number)	CERC	WES
Wave Refraction		
WAVE (720-X6-R1CH0)	*	*
MAIN (720-X6-R1CF0)	*	*
ZGRIDI (720-X6-R1CG0)	*	*
CONTOR (720-X6-R19X0)	*	*
Storm Surge		
SPLASH (720-X6-R18T0)	*	N/A
1/ SYSTEM 21	*	*
SURGE (752-X6-R1590)	*	*
SSURGE (752-X6-R195A)	*	*
SURGE II (722-X6-R19Q0)	*	*
SURGE III	*	N/A
Inlets		
INLET II (752-X6-R1AN0)	*	*
Beach Profiling		
BPAS	*	*
Breakwaters		
OVER (752-X6-R1CY0)	*	*
MADSEN2 (752-X6-R1CP1)	*	*
BWFLOW2 (752-X6-R1ANC)	*	*
Soil Mechanics		
MAGSET (741-F3-R0105)	N/A	*
(741-F3-R0104)	N/A	*
(741-F3-R0028)	N/A	*
(741-F3-A2530)	N/A	*
(741-F3-A2160)	N/A	*
(741-F3-R0003)	N/A	*
(741-F3-F5030)	N/A	*
(741-F3-F5020)	N/A	*
(741-F3-F5010)	N/A	*
CELLSL (713-F3-F1050)	N/A	*
SSIWALL (713-F3-R0051)	N/A	*
ANCWAL (713-F3-F3010)	N/A	*
Dredging		
(733-G1-K7100, K7110, K711A, K711B, K711C)	N/A	*
(731-K8-K7010)	N/A	*
(731-G1-F304B)	N/A	*
(501-F5-E401A)	N/A	*
(501-F5-E401B)	N/A	*
Wave Height and Setup		
(720-X6-R1CB0)	*	*

1/ This is a proprietary program from the Danish Hydraulic Institute. It can be run by Districts and Divisions, but under CERC/WES guidance.

* Available

N/A Not available

COMPUTER PROGRAMS BY SUBJECT AREA:

Wave Refraction: Two wave refraction programs, WAVE (720-X6-R1CH0) and MAIN (720-X6-R1CF0) are available. Required input for WAVE and MAIN are bottom topography and wave characteristics. WAVE tracks individual wave rays and produces a graphic display and tabulated wave heights. MAIN tabulates refracted wave directions and heights and plots the wave direction unit vector at the grid points.

Two additional programs, ZGRID1 (720-X6-R1CG0) and CONTOR (720-X6-R19X0) are often used with wave refraction programs. ZGRID1 takes randomly spaced depths from National Ocean Survey tapes or other sources and produces a regularly spaced depth grid for use in wave refraction programs. CONTOR draws contours on the grid produced by ZGRID1, or any two dimensional field.

Storm Surge: CERC and ECPL have a number of different programs on storm surge. With the exception of SPLASH (720-X6-R18T0), all programs require bathymetry data for the area of interest as input. SURGE II (722-X6-R19Q0) predicts storm surge levels in estuaries due to winds and tides. Required input includes bathymetric data, topographic data, location of barriers and channels, distribution of wind stress, and the tidal forcing function. Output produced includes surge heights and mass transport values as a function of time. SURGE III (see CETN-I-16) is an updated version of SURGE II; it has an improved wind model.

A number of programs for surge predictions on the open coast also are available. System 21 (see CETN-I-4) can be applied to the Continental Shelf and large coastal regions (hundreds of miles of coast) as well as smaller individual bay/inlet systems. SURGE (752-X6-R1590), a simple bathystropic model, predicts surge heights on a line perpendicular to the coast. SSURGE (722-X6-R195A), predicts surge levels at many points along the coast over distances up to hundreds of miles. SPLASH (720-X6-R18T0), is a program developed by the National Oceanic and Atmospheric Administration. It has the bathymetry of the Gulf and East Coast as a part of the program. Although the program is not completely documented at this time, there is sufficient information available to operate it. Several other storm surge models are being used by CERC and WES and will be documented in the future.

Inlets: INLET II (752-X6-R1AN0) is a lumped parameter numerical model that predicts velocities, discharges, and bay levels for a multiple bay/inlet system. INLET II is an updated version of INLET, described in CETN-IV-1. Other inlet models are being used by CERC and WES and will be documented in the future.

Beach Profiling: The beach profile analysis system (BPAS) is described in CETN-II-2. From an input of distance and elevation pairs from beach profiles, BPAS can plot the profiles, compute unit volume changes, compute distances to a fixed elevation, and perform a number of other useful measurements.

Breakwaters: Program OVER (752-X6-R1CY0) estimates coefficients of wave transmission for overtopping of an impermeable breakwater. It is used for irregular waves; coefficients for monochromatic waves can also be calculated. Required as input are breakwater geometry and wave conditions. Output consists of a table of wave transmission coefficients.

MADSEN2 (752-X6-R1CP1) predicts wave transmission and reflection coefficients for monochromatic or irregular waves striking rubblemound structures. Input required are breakwater dimensions and layer characteristics, and wave periods and heights. Output is in tabular form; it includes transmitted wave heights.

BWFLOW2 (752-X6-R1ANC) estimates flow through offshore breakwater gaps generated by wave overtopping. Input required includes breakwater geometry, spacing of gaps, water depth, significant wave heights and periods. The program calculates velocity of outflow through the gaps, ponding levels, and runoff.

Soil Mechanics: The Programs Library has a large number of computer programs related to soil mechanics. The following programs are of particular interest to the coastal engineer.

Program MAGSET (741-F3-R0105) calculates the amount of settlement of multi-layered soil profiles containing granular and/or cohesive soil layers. The program incorporates empirical correlations for standard penetration tests and static cone penetrometer results for calculations in granular soil.

The following programs calculate slope stability by different methods:

(741-F3-R0104) Modified Swedish, (741-F3-R0028 and 741-F3-A2530 and 741-F3-A2160) Wedge, (741-F3-R0003) Circular Arc, (741-F3-F5030) Slip Circle with Side Forces, and (741-F3-F5020) Generalized Failure Surface.

There is also a program (741-F3-F5010) that determines the critical stresses for applied structural loads using either the Boussinesq or Westerguard method of solution. The program can also calculate stresses under a rectangular loaded area and embankments.

Program CELLSL (713-F3-F1050) aids in the design of a cellular sheet pile structure. SSIWALL (713-F3-R0051) analyses both anchored and cantilivered retaining walls using a one dimensional finite element code. ANCWAL (713-F3-F3010) designs anchored bulkhead walls by four methods: equivalent beam, free earth support, elastic line, and equal moment.

Dredging: A series of programs (733-G1-K7100, K7110, K711A, K711B, K711C), on computing dredging quantities are available. Based on position and depth data acquired by an automated hydrographic survey system, the programs edit and correct the data, compute cross section for use in quantity computations, and plot plan views and cross sections. Another program (731-K8-K7010) computes dredging quantities for cost estimates using procedures developed by SAW. Program (731-61-F-304B) computes the amount of dredged material for a trapezoidal channel.

There are two programs for evaluating the effects of channel deepening. The first program (501-F5-E401A) determines the unit cost for shipment of cargo in bulk carriers and tankers on existing and proposed channels for various depths. A second program (501-F5-E401B) uses the results of the first program to determine the cost-benefit ratios for proposed channels of various depths.

Wave Height and Setup: Program GODAS (720-X6-R1CB0) estimates wave height and wave setup in the nearshore zone (see CETN-I-2) due to irregular waves.

NEW PROGRAMS: The WES Program Library is actively seeking new programs and will provide instructions for properly documenting programs.

ADDITIONAL INFORMATION: For additional information contact the CERC ADP Coordinator (CERDP), Kingman Building, Fort Belvoir, Virginia, 22060, (202) 325-7410, or the WES Engineer Computer Programs Library, Box 631, Vicksburg, Mississippi, 39180, (601) 634-2581.

REFERENCES:

- U.S. ARMY, CORPS OF ENGINEERS, COASTAL ENGINEERING RESEARCH CENTER, "Computer Program: Godas-Waves & Wave Setup," CETN-I-2, Fort Belvoir, VA, 1979.
- U.S. ARMY, CORPS OF ENGINEERS, COASTAL ENGINEERING RESEARCH CENTER, "Computer Program: S21 - Coastal Water Level Variations and Flows," CETN-I-4, Fort Belvoir, VA, 1981.
- U.S. ARMY, CORPS OF ENGINEERS, COASTAL ENGINEERING RESEARCH CENTER, "Computer Programs - Storm Surge," CETN-I-16, Fort Belvoir, VA, 1981.
- U.S. ARMY, CORPS OF ENGINEERS, COASTAL ENGINEERING RESEARCH CENTER, "Computer Program: BPAS," CETN-II-2, Fort Belvoir, VA, 1980.
- U.S. ARMY, CORPS OF ENGINEERS, COASTAL ENGINEERING RESEARCH CENTER, "Computer Program: INLET," CETN-IV-1, Fort Belvoir, VA, 1979.
- U.S. ARMY, CORPS OF ENGINEERS, WATERWAYS EXPERIMENT STATION, "WES Engineering Computer Programs Library Catalog," Vicksburg, MD, 1982.